

Claims:

1. An irrigation probe comprising:

a generally rigid probe body having proximal and distal ends;

an electrode comprising an elongated electrode body having first and second ends, wherein

5 the electrode defines an inner cavity, the electrode having at least one irrigation opening through which fluid can pass from the inner cavity to the outside of the electrode, the electrode being fixedly attached to the distal end of the probe body at a point along the elongated body of the electrode between the first and second ends wherein the distal end of the probe body and the electrode form an angle α greater than 0° ; and

10 means for introducing fluid into the inner cavity.

2. An irrigation probe according to claim 1, wherein the means for introducing fluid into the inner cavity comprises an infusion tube having proximal and distal ends wherein the distal end of the infusion tube is in fluid communication with the inner cavity.

15 3. An irrigation probe according to claim 2, wherein the infusion tube extends through the probe body.

20 4. An irrigation probe according to claim 2, wherein the probe body, the infusion tube and the electrode together comprise a single unitary generally hollow body.

5. An irrigation probe according to claim 1, further comprising a handle mounted at the proximal end of the probe body, the handle comprising a housing having a generally open interior.

25 6. An irrigation probe according to claim 1, wherein the generally rigid probe body comprises a malleable material.

7. An irrigation probe comprising:

a generally rigid probe body having proximal and distal ends;

an electrode comprising an elongated electrode body having first and second ends, wherein the electrode defines an inner cavity, the electrode having at least one irrigation opening through which fluid can pass from the inner cavity to the outside of the electrode, the electrode being fixedly attached to the distal end of the probe body at a point along the elongated body of the electrode between the first and second ends wherein the distal end of the probe body and the electrode form an angle α greater than 0° ;

a handle mounted to the proximal end of the probe body; and

an infusion tube having proximal and distal ends, wherein the distal end of the infusion tube is in fluid communication with the inner cavity.

8. An irrigation probe according to claim 7, wherein the infusion tube extends through the probe body.

9. An irrigation probe according to claim 7, wherein the generally rigid probe body and the electrode together comprise:

a single generally hollow tubular body that forms the infusion tube; and

a non-conductive sheath covering a portion of the tubular body proximal to the electrode.

10. An irrigation probe according to claim 9, wherein the tubular body has an inner diameter ranging from about 0.40 inch to about 0.80 inch and an outer diameter ranging from about 0.50 inch to about 0.90 inch.

11. An irrigation probe according to claim 9, wherein the tubular body has an outer diameter ranging from about 0.50 inch to about 0.70 inch.

12. An irrigation probe according to claim 9, wherein the tubular body has an inner diameter ranging from about 0.40 inch to about 0.60 inch.

13. An irrigation probe according to claim 7, wherein the rigid probe body is made of a malleable material.

14. An irrigation probe according to claim 9, further comprising a flexible plastic tubing attached to the proximal end of the tubular body for introducing fluid into the inner cavity of the electrode.

15. An irrigation probe according to claim 7, wherein the at least one irrigation opening is located on the surface of the electrode to be in contact with the tissue to be ablated.

16. An irrigation probe according to claim 7, wherein the at least one irrigation opening comprises at least three holes arranged along the length of the elongated body of the electrode.

17. An irrigation probe according to claim 7, wherein the probe body has a length ranging from about 3.5 inches to about 12 inches.

18. An irrigation probe according to claim 7, wherein the probe body has a length ranging from about 5 inches to about 10 inches.

19. An irrigation probe according to claim 7, wherein the electrode has a length ranging from about 0.50 inch to about 1.5 inches.

20. An irrigation probe according to claim 7, wherein the electrode has a length ranging from about 0.75 inch to about 1.25 inches.

21. An irrigation probe according to claim 7, wherein the angle α formed between the distal end of the probe body and the elongated electrode body is greater than about 10° .

22. An irrigation probe according to claim 7, wherein the angle α formed between the distal end of the probe body and the elongated electrode body is greater than about 20° .

5 23. An irrigation probe according to claim 7, wherein the angle α formed between the distal end of the probe body and the elongated electrode body ranges from about 70° to about 110° .

10 24. An irrigation probe according to claim 7, wherein the angle α formed between the distal end of the probe body and the elongated electrode body ranges from about 85° to about 95° .

25. An irrigation probe according to claim 7, wherein the point along the elongated body is approximately equidistant between the first and second ends.

15 26. An irrigation probe according to claim 7, wherein the generally rigid probe body comprises:
tubing having proximal and distal ends and first and second lumens extending therethrough, wherein the electrode is mounted at the distal end of the tubing; and
a stiffening wire having proximal and distal ends that extends through the second lumen of the tubing;
wherein the infusion tube extends at least a part of the way through the first lumen of the tubing, wherein the distal end of the infusion tube is in fluid communication with the inner cavity of the electrode.

20 27. An irrigation probe according to claim 26, wherein the stiffening wire is made of a malleable material.

25 28. An irrigation probe according to claim 26, wherein the at least one irrigation opening is located on the surface of the electrode to be in contact with the tissue to be ablated.

29. An irrigation probe according to claim 26, wherein the at least one irrigation opening comprises at least three holes arranged along the length of the elongated body of the electrode.

30. An irrigation probe according to claim 26, wherein the probe body has a length ranging from about 3.5 inches to about 12 inches.

31. An irrigation probe according to claim 26, wherein the probe body has a length ranging from about 5 inches to about 10 inches.

10 32. An irrigation probe according to claim 26, wherein the probe body has a length ranging from about 7 inches to about 8 inches.

15 33. A method for treating atrial fibrillation in a patient comprising:
opening the heart of the patient; and
ablation at least one linear lesion in the heart tissue using an irrigation probe as recited in
claim 8.

20 34. An irrigation probe comprising:
a generally rigid probe body having proximal and distal ends;
a generally flexible irrigation tube having first and second ends, the irrigation tube defining an inner cavity, wherein the irrigation tube generally forms a loop and at least one end is fixedly attached to the distal end of the probe body, the irrigation tube having at least one irrigation opening through which fluid can pass from the inner cavity to the outside of the irrigation tube;
means for introducing fluid into the inner cavity of the irrigation tube; and
25 an electrode comprising a flexible metal ribbon having first and second ends, wherein the metal ribbon is coiled around the irrigation tube to form coils, and wherein space is provided between the coils to allow fluid to pass from the irrigation tube to the outside of the electrode.

35. An irrigation probe according to claim 34, wherein both the first and second ends of the irrigation tube are fixedly attached to the distal end of the probe body.

36. An irrigation probe according to claim 34, wherein the first and second ends of the electrode are fixedly attached to the distal end of the probe body.

37. An irrigation probe according to claim 34, wherein the probe further comprises an electrode lead wire with proximal and distal ends wherein the proximal end of the electrode lead wire is electrically connected to a source of ablation energy and the distal end of the electrode lead wire is electrically connected to the electrode.

38. An irrigation probe according to claim 34, wherein the means for introducing fluid into the inner cavity comprises an infusion tube having proximal and distal ends, wherein the distal end of the infusion tube is in fluid communication with the inner cavity.

39. An irrigation probe according to claim 38, further comprising a handle mounted at the distal end of the probe body, the handle comprising a housing having a generally open interior.

40. An irrigation probe according to claim 34, wherein the generally rigid probe body comprises a malleable material.

41. An irrigation probe according to claim 34, wherein the flexible metal ribbon is made of nitinol.

42. An irrigation probe comprising:

a generally rigid probe body having proximal and distal ends;

a generally flexible irrigation tube having first and second ends, the irrigation tube defining an inner cavity, wherein the irrigation tube generally forms a loop and at least one end is fixedly

attached to the distal end of the probe body, the irrigation tube having at least one irrigation opening through which fluid can pass from the inner cavity to the outside of the irrigation tube;

an electrode comprising a flexible metal ribbon having first and second ends, wherein the metal ribbon is coiled around the irrigation tube to form coils, and wherein space is provided between the coils to allow fluid to pass from the irrigation tube to the outside of the electrode;

5 a handle mounted to the proximal end of the probe body; and

an infusion tube having proximal and distal ends, wherein the distal end of the infusion tube is in fluid communication with the inner cavity.

10 43. An irrigation probe according to claim 42, wherein the generally rigid probe body comprises:

a generally rigid tubular body having proximal and distal ends, wherein the tubular body has at least one irrigation opening at its distal end through which fluid can pass to the inner cavity of the irrigation tube; and

15 a non-conductive sheath covering the tubular body.

44. An irrigation probe according to claim 43, wherein the tubular body has an inner diameter ranging from about 0.40 inch to about 0.80 inch and an outer diameter ranging from about 0.50 inch to about 0.90 inch.

20 45. An irrigation probe according to claim 43, wherein the tubular body is made of a malleable material.

46. An irrigation probe according to claim 43, further comprising a flexible plastic tubing 25 attached to the proximal end of the tubular body for introducing fluid into the tubular body.

47. An irrigation probe according to claim 42, wherein the probe body has a length ranging from about 3.5 inches to about 12 inches.

48. An irrigation probe according to claim 42, wherein the probe body has a length ranging from about 7 inches to about 8 inches.

49. An irrigation probe according to claim 42, wherein the loop has a diameter ranging 5 from about 0.50 inch to about 1.5 inches.

50. An irrigation probe according to claim 42, wherein the loop has a diameter ranging from about 0.75 inch to about 1.25 inches.

10 51. An irrigation probe according to claim 42, wherein the metal ribbon is made of nitinol.

52. An irrigation probe according to claim 42, wherein the generally rigid probe body comprises:

15 tubing having proximal and distal ends and first and second lumens extending therethrough, wherein the irrigation tube and electrode are mounted at the distal end of the tubing;

an infusion tube that extends at least part of the way through the first lumen of the tubing, wherein the distal end of the infusion tube is in fluid communication with the inner cavity of the irrigation tube; and

20 a stiffening wire having proximal and distal ends that extends through the second lumen of the tubing.

53. An irrigation probe according to claim 52, wherein the stiffening wire is made of a malleable material.

25 54. An irrigation probe according to claim 52, wherein the probe body has a length ranging from about 3.5 inches to about 12 inches.

55. An irrigation probe according to claim 52, wherein the probe body has a length ranging from about 7 inches to about 8 inches.

56. A method for treating atrial fibrillation in a patient comprising:

opening the heart of the patient; and

ablation at least one linear lesion in the heart tissue using an irrigation probe as recited in

claim 42.

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